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A First Look at the New ARAC Dispersion Model*

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The Department of Energy's Atmospheric Release Advisory Capability (ARAC) provides real-time forecasts of dispersion from airborne pollutant releases for a wide range of customers. To assure that it will continue to provide the highest quality service to its customers, ARAC is in the midst of building ARAC III, the next generation ARAC system. As part of this undertaking, we are developing a new dispersion model to replace ADPIC, the current ARAC dispersion model. In this presentation we will describe the major features of the new model and highlight differences with ADPIC. We will also present some early results from the model.

Given the mean wind fields, the new dispersion model solves the turbulent, advection-diffusion equation via a Lagrangian particle, Monte-Carlo method. Within a simulation, the pollutant is represented statistically as a random sample of marker particles. These particles are then moved through the domain under the influence of various physical processes such as advection and turbulent diffusion. Concentrations are then calculated by summing up the contributions of each particle within a sampling volume. One of the major differences between the new model and ADPIC is the representation of the earth's surface. Within ADPIC the surface is approximated via a grid of constant size rectangular cells leading to a discontinuous "stair step" representation of terrain. The new model represents the surface as the union of grid cells whose bottoms are bilinear surfaces on the terrain. Also, in contrast to ADPIC's use of constant sized cells on which to represent the wind field, the new model accepts winds on horizontally regular grids that may be nested. These wind field grids can also be vertically graded in a σ_z coordinate system allowing higher resolution of the winds within regions of interest such as the boundary layer. This wind grid structure facilitates the use of winds from a mesoscale dynamics model, a major new component of ARAC III.

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